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1995



Why Leaves change color



USDA Forest Service



WHY LEAVES CHANGE COLOR

It requires no vivid imagination to picture Mother Nature going about on autumn days with a liberal supply of paint, coloring the leaves of trees and other plants, producing the riot of red, purple, orange and yellow found in the woods. Each fall we revel in the beauty of trees, knowing well that it's only a fleeting pleasure. Before long the leaves will flutter away to become part of the rich carpet that covers the forest floor.

Some people suppose that Jack Frost is responsible for the color change, but he is not. Some leaves begin to change color before it frosts. According to an Indian legend, celestial hunters slew the Great Bear in autumn. His blood dripping on the Forest changed many leaves to red. Other leaves were turned yellow by the fat splattering out of the kettle as the hunters cooked the meat. Other peoples have other legends, but we now know that change in coloring is the result of chemical processes taking place in trees as the season changes from summer to winter.

During spring and summer, the leaves serve as factories where foods necessary for tree growth are manufactured. This food-making process occurs in leaf cells containing the pigment chlorophyll, which gives the leaf its color. The chlorophyll absorbs energy from sunlight and uses it to transform carbon dioxide and water to carbohydrates, such as sugars and starch. Leaves also contain yellow or orange carotenoids which, for example, give the carrot its color. Most of the year these yellowish colors are masked by greater amounts of green coloring. But in the fall, partly because of changes in the periods of daylight and changes in temperature, the leaves stop their food-making process. The chlorophyll breaks down, the green color disappears, and the yellowish colors become visible, giving leaves part of their fall splendor.

At the same time other chemical changes may occur causing the formation of additional pigments that vary from yellow to red and blue. Some chemical changes cause the reddish and purplish fall colors of the leaves of trees such as dogwood and sumacs. Others give the sugar maple its brilliant orange or fiery red and yellow. The autumn foliage of quaking aspen, birch and hickory shows only yellow colors. Many oaks and other trees are mostly brownish, while beech turns golden bronze. These colors are due to the mixing of varying amounts of the chlorophyll and other pigments in the leaf in autumn.

Fall weather conditions favoring formation of brilliant red autumn color are warm sunny days followed by cool nights with temperatures below 45 degrees Fahrenheit. Much sugar is made in the leaves during the daytime, but cool nights prevent movement of sugar from the leaves. The sugars trapped in the leaves form the red pigment, anthocyanin. Familiar trees with red or scarlet leaves in autumn are red maple, silver maple, sweetgum, black tupelo or blackgum, northern red oak and scarlet oak.

The degree of color may vary from tree to tree. For example, leaves directly exposed to the sun may turn red, while those on the shady side of the same tree may be yellow. The foliage of some trees just turns dull brown from death and decay and never shows bright colors.

Colors on the same tree may vary from year to year, depending upon the combination of weather conditions. When there is much warm, cloudy, rainy weather in the fall, the leaves may have less red coloration. The smaller amount of sugar made in the reduced sunlight moves out of the leaves during the warm nights. Thus, no excess sugar remains in the leaves to form the pigments.

Only a few regions of the world have these showy displays. Eastern United States and southeastern Canada have large areas of deciduous forests with broad-leaved trees and favorable weather conditions, including ample rainfall, for vivid fall colors. Some western areas, especially in the mountains, also have bright colorations. Eastern Asia and southwestern Europe have bright colors as well. The broad-leaved evergreen trees in the tropical rain forests shed their leaves very gradually, one at a time, turning yellow and falling. In the seasonal tropical forests, the foliage becomes parched and brown with the coming of the dry season.



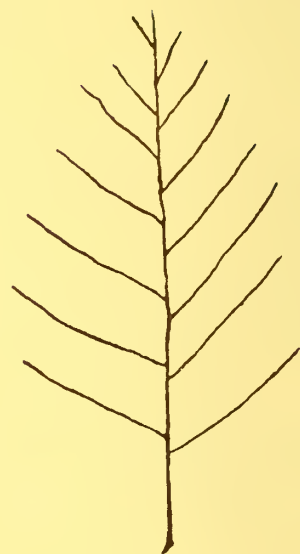
As fall colors appear, other changes are taking place. At the base of the leafstalk where it's attached to the twig, a layer of cells develops and gradually severs tissues that support the leaf. At the same time, Nature heals the break, so that when the leaf is blown off or has fallen from its own weight, the place where it grew on the twig is marked by a leaf scar.

Most broad-leaved trees in the Northeast shed their leaves in the fall. However, the dead brown leaves of the oaks and a few other species may stay on the tree until growth starts again in the spring. In the Southeast, where the winters are mild, some broad-leaved trees are evergreen. The leaves stay on the trees during winter and keep their green color. Most conifers -- pines, spruces, firs, hemlocks, cedars -- are evergreen in both the North and South. The needlelike or scalelike leaves remain green all year, though they often become brownish green where winters are cold. Individual leaves may stay on the trees for two or more years.

Nature has provided fertile forest floors using fallen leaves. These leaves contain large amounts of valuable elements, particularly calcium and potassium, which were originally part of the soil. Decomposition of the leaves enriches the top layers of the soil by returning part of the elements borrowed by the tree. Water-absorbing humus is provided at the same time.

It's easy to copy brightly colored leaves with crayons or colored pencils. Place a leaf lower side up (because the veins on the lower side are usually raised). Put a sheet of thin paper or writing paper (not thick drawing paper) on top of the leaf. Next, holding the paper and leaf so they don't move, color the paper on the top of the leaf. Use fast slanting strokes as in shading. The shape and markings will be copied exactly. The veins and leaf border will show as heavier lines. Different colors can be used to match the shades or markings. After you have colored over all of the leaf, cut out the paper leaf with scissors. Green leaves can be copied the same way.

Leaf prints can be made with a stamp pad. Press the leaf lower surface down against the stamp pad with a piece of paper on top to avoid soiling the fingers; place the leaf, inked side down, on a sheet of white paper with another sheet of paper on top. Hold the leaf firmly and rub hard over it. When the upper sheet of paper and the leaf are removed, a printed copy of the leaf will remain. A scrapbook of leaf prints with names of trees is an interesting project for any boy or girl.



Revised August, 1995